SIEMENS

ACOM.net Server VC22B

AX

DICOM Conformance Statement

HL7 Interface Statement

V1.0 08-Mar-07

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Network Conformance Statement

1 Conformance Statement Overview

The ACOM.net Server is a dedicated Archive (either embedded or DICOM-based) for storing SOP Instances within a Cardiology Lab environment. The ACOM.net Server is designed to be integrated with dedicated Siemens clients (e.g. ACOM.PC 5.01 and higher) as well as other DICOM clients. The ACOM.net Server supports the storage of SOP Instances utilizing the DICOM "Storage Service Class" and "Storage Commitment Push Model Service Class". For retrieval of SOP Instances from the Server the DICOM "Query/Retrieve Service Class" is available. The ACOM.net Server's implementation is "*syngo*®-based" (Siemens registered trademark). Optionally, a HL7 patient reconciliation interface can be activated, including Prefetching of patient data from near-line to online.

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SOP Classes	SOP Class UID	SCU	SCP
Verification			
Verification	1.2.840.10008.1.1	Yes	Yes
Transfer			
X-Ray **A**ngiographic Image Storage	1.2.840.10008.5.1.4.1.1.12.1	Yes	Yes
Ultra**S**ound Image Storage	1.2.840.10008.5.1.4.1.1.6.1	Yes	Yes
Ultra**S**ound Multi-Frame Image Storage	1.2.840.10008.5.1.4.1.1.3.1	Yes	Yes
Ultra**S**ound Image Storage (retired)	1.2.840.10008.5.1.4.1.1.6	No	Yes
Ultra**S**ound Multi-Frame Image Storage (retired)	1.2.840.10008.5.1.4.1.1.3	No	Yes
Nuclear **M**edicine Image Storage	1.2.840.10008.5.1.4.1.1.20	Yes	Yes
Secondary **C**apture Image Storage	1.2.840.10008.5.1.4.1.1.7	Yes	Yes
12-lead ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.1	Yes	Yes
Ambulatory ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.3	Yes	Yes
Basic Voice Audio Waveform Storage	1.2.840.10008.5.1.4.1.1.9.4.1	Yes	Yes
Cardiac Electrophysiology Waveform Storage	1.2.840.10008.5.1.4.1.1.9.3.1	Yes	Yes
General ECG Waveform Storage	1.2.840.10008.5.1.4.1.1.9.1.2	Yes	Yes
Hemodynamic Waveform Storage	1.2.840.10008.5.1.4.1.1.9.2.1	Yes	Yes
Transfer (Private SOP Class)			
Syngo Non-Image Storage	1.3.12.2.1107.5.9.1	Yes	Yes
Storage Commitment			
Storage Commitment Push Model	1.2.840.10008.1.20.1	Yes	Yes
Query/Retrieve			
Patient Root Q/R - FIND	1.2.840.10008.5.1.4.1.2.1.1	No	Yes
Patient Root Q/R - MOVE	1.2.840.10008.5.1.4.1.2.1.2	Yes	Yes
Patient Root Q/R - GET	1.2.840.10008.5.1.4.1.2.1.3	No	Yes
Study Root Q/R - FIND	1.2.840.10008.5.1.4.1.2.2.1	No	Yes
Study Root Q/R - MOVE	1.2.840.10008.5.1.4.1.2.2.2	Yes	Yes
Study Root Q/R - GET	1.2.840.10008.5.1.4.1.2.2.3	No	Yes
Patient/Study only Q/R - FIND	1.2.840.10008.5.1.4.1.2.3.1	No	Yes
Patient/Study only Q/R - MOVE	1.2.840.10008.5.1.4.1.2.3.2	No	Yes
Patient/Study only Q/R - GET	1.2.840.10008.5.1.4.1.2.3.3	No	Yes

Table 1. Network Services

Name	Value
Application Context Name	1.2.840.100008.3.1.1.1
Implementation Class UID	1.3.12.2.1107.5.4.11.1.1.42
Implementation Version Name	"ACOMNET_VC22B"

Table 2. Implementation Identifying Information

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3 Introduction

3.1 Revision History

Product	Product Version	Document Version	Date	Description
ACOM.net	VC22B	V1.0	08-Mar-07	Version for Final Text

Table 3. Revision History

3.2 Audience

This document is intended for hospital staff, health system integrators, software designers or implementers. It is assumed that the reader has a working understanding of DICOM.

3.3 Remarks

DICOM, by itself, does not guarantee interoperability. However, the Conformance Statement facilitates a first-level validation for interoperability between different applications supporting the same DICOM functionality as SCU and SCP, respectively.

This Conformance Statement is not intended to replace validation with other DICOM equipment to ensure proper exchange of information intended.

The scope of this Conformance Statement is to facilitate communication with Siemens and other vendors' Medical equipment. The Conformance Statement should be read and understood in conjunction with the DICOM 3.0 Standard [DICOM]. However, by itself it is not guaranteed to ensure the desired interoperability and a successful interconnectivity.

The user should be aware of the following important issues:

- The comparison of different conformance statements is the first step towards assessing interconnectivity between ACOM.net and other DICOM-conformant equipment.
- Test procedures should be defined and tests should be performed to validate the connectivity desired. DICOM itself and the conformance parts do not specify this.

3.4 Definitions, Terms and Abbreviations

Definitions, terms and abbreviations used in this document are defined within the different parts of the DICOM standard. Furthermore, the following definitions are applicable in this document:

Online storage - Images immediately accessible on an online RAID-cluster.

Near-line storage – Images from online storage copied onto Archive-System (e.g. MOD-/ CDR-Jukebox or external DICOM Archive). Images have to be copied back to online storage before access via DICOM Standard Interface is possible.

Offline storage - An archive medium containing the Images exists, but is removed from the near-line storage and therefore access is only possible via operator interaction.

Additional Abbreviations and terms are as follows:

AE	DICOM Application Entity
AET	Application Entity Title
ARI	ACOM.net Patient Reconciliation Interface
ASCII	American Standard Code for Information Interchange
DICOM	Digital Imaging and Communications in Medicine
HIS	Hospital Information System
HL7	Health Level 7
IOD	DICOM Information Object Definition
ISO	International Standard Organization
O	Optional Key Attribute
PDU	DICOM Protocol Data Unit
R	Required Key Attribute
RIS	Radiology Information System
SCU	DICOM Service Class User (DICOM client)
SCP	DICOM Service Class Provider (DICOM Server)
SOP	DICOM Service-Object Pair
U	Unique Key Attribute
UID	Unique Identifier
VR	Value Representation

4 Networking

4.1 Implementation Model

- **Verification**
  The ACOM.net Server DICOM Service Tool application requests Verification to proof the ability of a remote DICOM application to respond to DICOM messages. Responding to Verification requests from remote nodes is handled by the Storage SCP.

- **Storage**
  The ACOM.net client, other DICOM clients and modalities use the ACOM.net server as online- and near-line-storage for DICOM IODs. The ACOM.net clients will have access to those IODs with the help of the ACOM.net protocol. Other DICOM clients will have the possibility to retrieve instances from online storage only.
  Sending of DICOM IODs can only be initiated via DICOM standard interface, which is in particular the receiving of a C-MOVE request (see Query/Retrieve below). Furthermore, the Archive Manager can be configured to forward any accepted Standard SOP Image Instance to up to three network destinations, e.g. an Intranet Distribution Server.
  The ACOM.net DICOM network implementation is a Windows 2003 Server application and acts as SCP for the C-STORE and C-ECHO DICOM network services. DICOM IOD SOP instances received by the ACOM.net server will be stored online and then are being forwarded to the long-term storage of the server (either file-based storage or to a DICOM Archive). Via ACOM.net protocol interface the ACOM.net clients can access those SOP Instances sent to the Server from other DICOM modalities. Other Modalities can access the SOP Instances in online storage via DICOM Standard Interface (Query/Retrieve). Specially marked images (VIP patients) are excluded from auto-transfers.

- **Storage Commitment**
  The Storage Commitment service class defines an application-level class of service which facilitates the commitment to storage. It performs an additional task of commitment of composite objects apart from the network based storage of images as defined by the Storage Service class. The ACOM.net Server DICOM implementation supports the Storage Commitment Push Model as SCP. In case a DICOM Archive is configured for long-term storage, the ACOM.net Server Application will also act as a SCU for Storage Commitment.

- **Query/Retrieve**
  The query/retrieve service class defines an application-level class of services which facilitates the management of images and patient data. The ACOM.net Server DICOM application supports the query/retrieve services in a SCP role. In case a DICOM Archive is configured as near-line storage, ACOM.net supports Query/Retrieve internally as SCU to retrieve IODs to online.

4.1.1 Application Data Flow

The division of ACOM.net into the separate DICOM Application Entities represents a somewhat arbitrary partitioning of functionality. For the purpose of this document they are organized in this manner to detail their independent logical functionality.

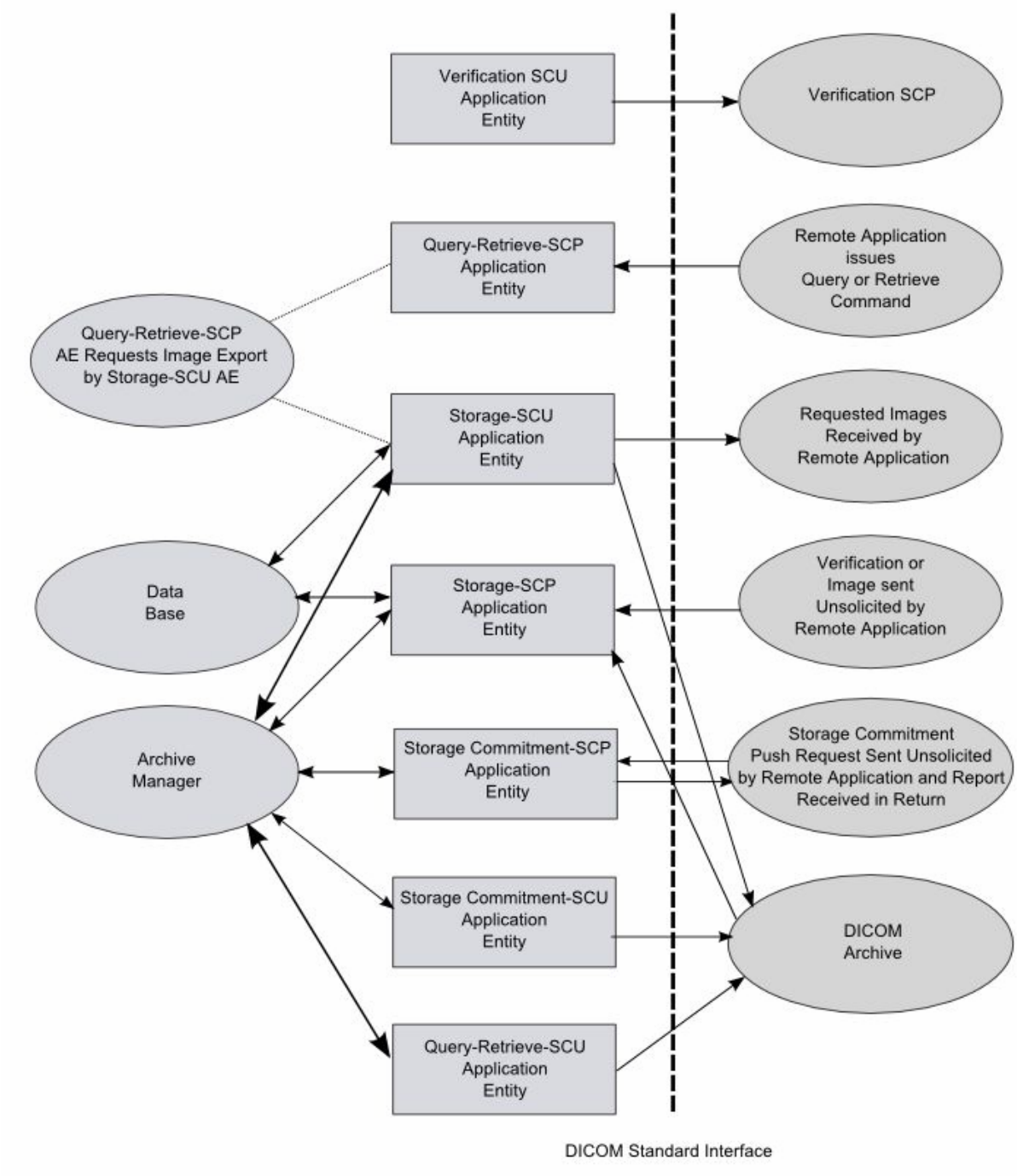

Table 4. ACOM.net DICOM Data Flow Diagram

- The ACOM.net Server DICOM Service Tool application opens an association when a "Test" of a remote application is requested during a configuration session. This can be done when entering new data to configure a remote application or to verify existing configuration data.

- The Storage SCU AE can send Composite SOP Instances. It handles requests from the Query/Retrieve SCP AE to transmit Images to a specific DICOM destination. In case the target destination is a DICOM Archive, the ACOM.net Server acts as a Storage Commitment SCU to receive an affirmative answer for commitment of storage from the Archive.

- The Storage SCP AE can receive incoming DICOM images and add them to the database. It can respond to external Storage and Verification Requests as a Service Class Provider (SCP) for C-STORE and C-ECHO requests.
  The Storage SCP AE can handle Storage Commitment Push Model Requests. It can thus be used to query whether the ACOM.net will confirm ownership and responsibility for specific Composite SOP Instances.
  The Storage SCP AE only supports image type Composite SOP Instances as indicated in Chapter 1 Conformance Statement Overview.

- The Query/Retrieve SCP AE can handle incoming query and retrieve requests. It can handle external queries for Patient, Study, Series, and Image data, and also handle Image retrieval requests. The Query/Retrieve SCP AE handles retrieval requests by issuing a command to the Storage SCU AE to send the requested Images to the destination specified by the Remote AE. The Query/Retrieve SCP AE functions as an SCP for C-FIND, C-MOVE and C-GET requests.
  In case a DICOM Archive is configured for long-term archival, the ACOM.net Server also acts as a Retrieve SCU in order to get instances back online from the archive. The Retrieve SCU AE functions as an SCU for C-MOVE requests.

4.1.2 Functional Definitions of Application Entities

4.1.2.1 Functional Definition of Verification-SCU AE

The ACOM.net Server DICOM Service Tool application opens an association when a "Test" of a remote application is requested during a configuration session. This can be done when entering new data for remote application configuration or to verify existing configuration data.

4.1.2.2 Functional Definition of Storage-SCU AE

The Storage SCU is invoked by the DICOM application itself as a sub-operation of a C-MOVE or C-GET retrieve service. An association is negotiated with the destination application entity and the image data is transferred using the C-STORE DIMSE-Service.

The Storage SCU is invoked by configuration of "auto-forward". The Archive Manager can "auto-forward" received Instances to up to three destinations, e.g. a workstation.

The third invocation for the Storage SCU is triggered by the Archive Manager in order to send instances to a DICOM Archive for long-term archival.

4.1.2.3 Functional Definition of Storage-SCP AE

The Storage SCP component of the ACOM.net Server DICOM application operates as back-ground server process. It is active when the machine is powered on and waits for Storage association requests. Upon accepting an association with a negotiated Presentation Context it starts to receive the Composite Image Objects and stores them to the local database ("Online Storage"). Transfer of images between ACOM.net or other clients and server is based on standard DICOM Storage service.

Verification requests will be processed and responded by Storage SCP component, too.

4.1.2.4 Functional Definition of Storage-Commitment-SCU AE

The Storage Commitment SCU is invoked when instances are sent to a DICOM Archive in order to request commitment for archival from the Archive.

4.1.2.5 Functional Definition of Storage-Commitment-SCP AE

The Storage Commitment SCP runs as background process and is ready to receive requests after the system is started.

The accepted Commitment requests will be kept in a "pending queue" for 24h until archival of related instances occurred. Consecutive to Archival time, during "Response Time Span", the server application regularly checks the pending queue for commit requests that are “ready-for-response” and tries to send the responses to the requesting modality. Another 24h time-out is setup for this. If the server is not able to send the commit response within this time frame, the commit request is removed from pending queue without further notice. The modality has to re-issue the Storage Commitment request.

4.1.2.6 Functional Definition of Retrieve-SCU AE

The ACOM.net Server DICOM retrieve SCU is triggered by the ACOM.net Server Query/Retrieve SCP in case a DICOM Archive is configured for long-time archival. A C-MOVE Request is initiated to get instances back to online from long-term storage.

4.1.2.7 Functional Definition of Query/Retrieve-SCP AE

The ACOM.net Server DICOM query/retrieve SCP responds to C-FIND DIMSE services from a remote SCU and depending on further remote requests, C-MOVE or C-GET, involves the Siemens ACOM.net Server DICOM application to initiate a C-STORE sub-operation (the local Storage SCU will be triggered and parameterized) to send image objects to a remote Storage SCP.

All components of the Siemens DICOM query/retrieve SCP application are operating as background Server processes. They are active when the machine is powered on and respond to queries based on the records stored in its database.

4.1.3 Sequencing of Activities

4.1.3.1 Verification

There are no sequencing constraints for verification.

4.1.3.2 Storage

Only Image SOP Instances that are received and, optionally, those that are transferred back from long-term archive, can be sent or copied as DICOM instances by the "auto-forward" function. This "auto-forward" will occur immediately after the images have been received and checked for long-term archival capability or after being transferred back to “online storage”.

The Time of transfer depends on the load of the auto-forward queue. The time of transfer from online to near-line storage is not correlated to this "auto-forward" activity.

4.1.3.3 Storage Commitment

- The incoming Storage Commitment trigger is kept in the pending queue.
- A trigger for long-term archival is derived from this. Depending on configuration archival time can be hours later, e.g. during night. For archiving to be completed, there is a 24h default time-out (Time Window for Archival).
- Consecutively to archival, the server application will send the commit response to the requesting modality. There is another 24h default time-out until commit response is completed (Time Window for Storage Commitment Response). It might be necessary to increase the Time Window to 72h, in case the Modality is turned off during a weekend and can not accept incoming responses.

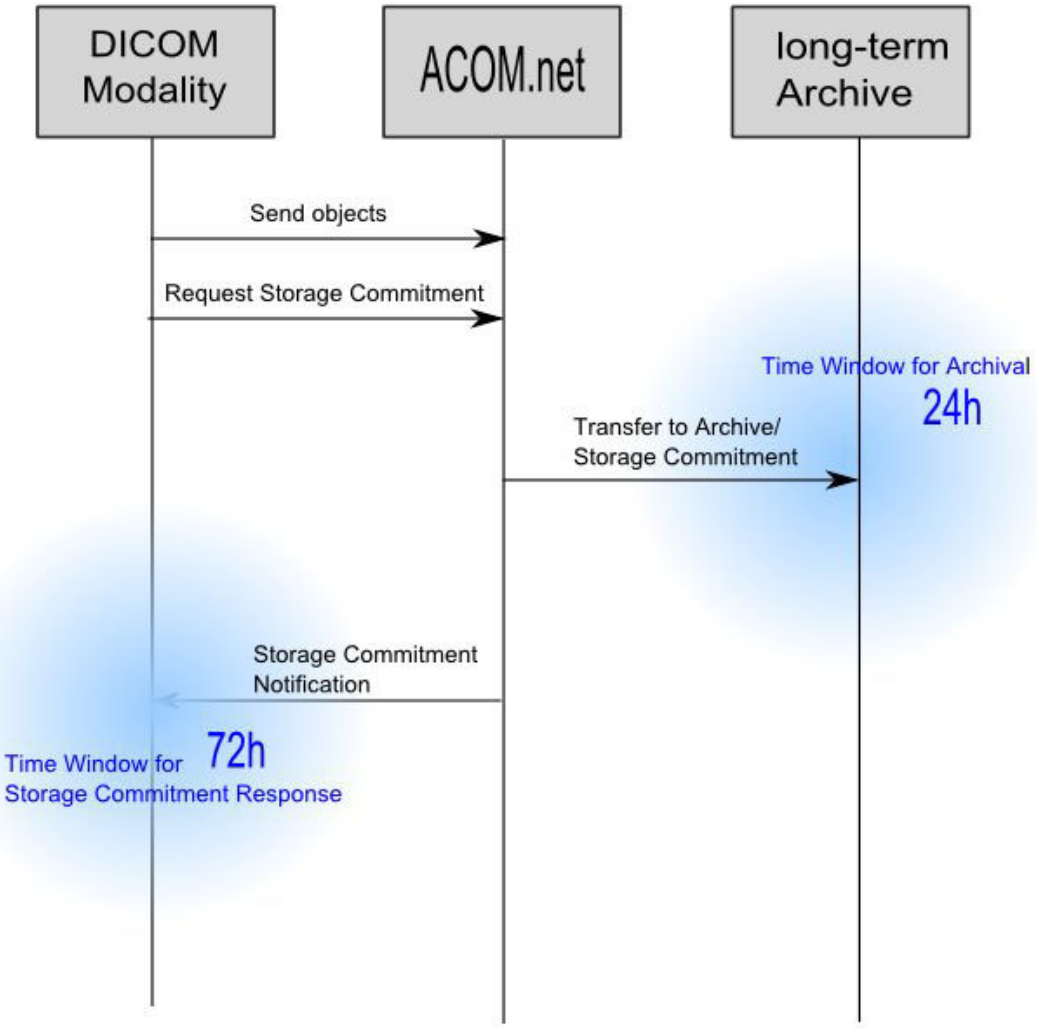

Table 5. Storage Commitment Sequencing Constraints

4.1.3.4 Query/Retrieve

With the Query interface, all data (online, near-line, offline) can be accessed for searching and matching. Whereas retrieving of images (Instances) is only possible from **online** storage. Dedicated clients of the ACOM.net Server system have the capability to initiate transport requests for moving images from near-line to online storage.

Any DICOM C-MOVE request on an IE that has subsequent instances stored "near-line" will trigger the Server to "move online" all these subsidiary level instances. Despite this implicit transfer trigger, the C-MOVE request will initially fail in this case. In case a DICOM Archive is connected to the ACOM.net, "move online" will be initiated by a C-MOVE Request to the DICOM Archive. Please see also Table 6: Query/Retrieve Sequencing Constraints.

In case "Prefetching" is activated, HL7 events for a given patient will trigger to move any accessible data of this patient from near-line to online. This reduces the probability that a C-MOVE Request will fail initially.

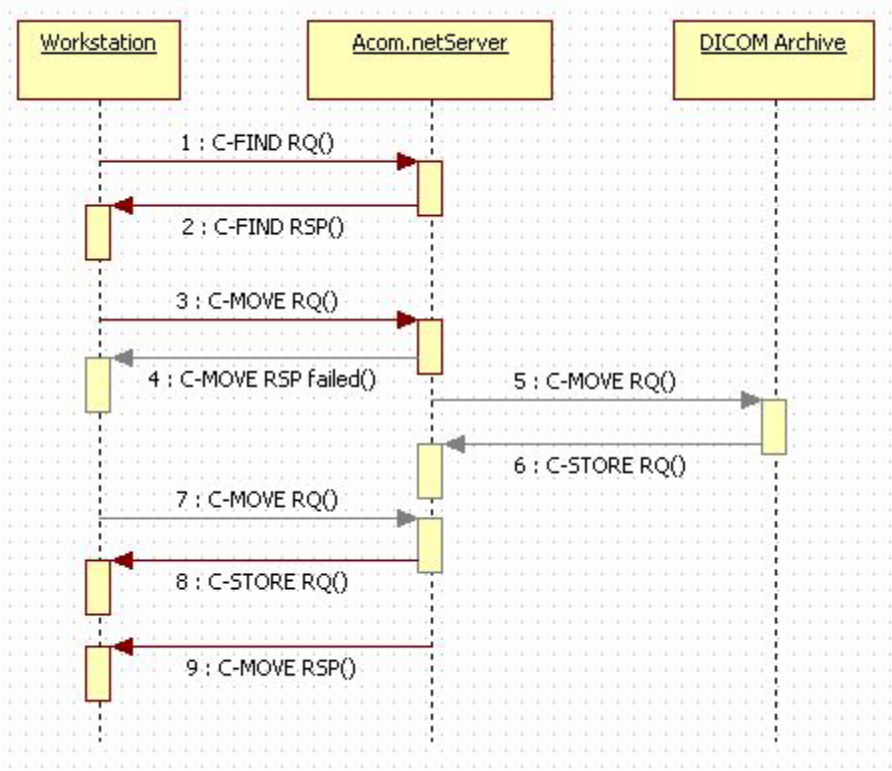

Table 6. Query/Retrieve Sequencing Constraints

4.2 Application Entity Specification

4.2.1 Verification SCU AE Specification

4.2.1.1 SOP Classes

For SOP Classes supported, please refer to Table 1 Network Service Section „Verification“ on page 2.

4.2.1.2 Association Establishments Policies

4.2.1.2.1 General

The ACOM.net Server DICOM Service Tool application attempts to open an association for verification request whenever the "Test" function is activated during network configuration of a remote DICOM application.

4.2.1.2.2 Number of Associations

The ACOM.net Server DICOM Service Tool application initiates one association at a time to request verification.

4.2.1.2.3 Asynchronous Nature

The ACOM.net Server DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

4.2.1.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to Table 2 Implementation Identifying Information on page 2.

4.2.1.3 Association Initiation Policy

4.2.1.3.1 Activity – Request Verification “Test”

4.2.1.3.1.1 Description and Sequencing of Activity

The Verification SCU C-ECHO request is initiated by Service and Configuration SW environment whenever a "Test" is requested. If an association to a remote Application Entity is successfully established, Verification with the configured AET is requested via the open association. If the C-ECHO Response from the remote Application contains a status other than "Success" this will be indicated in the service environment and the association is closed.

4.2.1.3.1.2 Proposed Presentation Contexts

The ACOM.net Server DICOM application will propose Presentation Contexts as shown in the following table:

Presentation Context Table – Verification SCU					
Abstract Syntax		Transfer Syntax		Role	Extended Negotiation
Name	UID	Name List	UID List		
Verification	1.2.840.10008.1.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None

Table 7. Presentation Context Table “Verification”

4.2.1.3.1.3 SOP Specific Conformance – Verification SCU

The Application conforms to the definition of the Verification SCU in accordance to the DICOM Standard.

4.2.1.4 Association Acceptance Policy

The Verification SCP is part of the Storage SCP

4.2.2 Storage SCU AE Specification

4.2.2.1 SOP Classes

For SOP Classes supported, please refer to Table 1 Network Service Sections „Transfer“ on page 2.

4.2.2.2 Association Establishments Policies

4.2.2.2.1 General

When configured, the Archive Manager will trigger the Storage Application (SCU Component) to perform a DICOM Send operation for every SOP Instance. Up to three different destinations can be configured and operated in parallel. To each destination an association request is sent and upon successful negotiation, the transfer is started. SOP Instances received with compressed Transfer Syntax, will be transmitted "as is", i.e. no conversion of Transfer Syntax (i.e. Decompression) will be performed. Images received with compressed Transfer Syntax, will be sent out with compressed Transfer Syntax.

Furthermore, upon receiving a C-MOVE request, the ACOM.net Server DICOM application will activate the DICOM Storage Application. An association request is sent to the destination AE and upon successful negotiation of a Presentation Context the transfer is started.

In case a DICOM Archive is connected to the ACOM.net Server, each SOP instance received by the ACOM.net Server will be sent to the DICOM Archive. If configured, the Storage of these instances will be commited (see Chapter Storage Commitment: 4.1.3.3)

The default PDU size used will be 256 KB.

4.2.2.2.2 Number of Associations

The ACOM.net Server DICOM application is able to initiate several associations at a time, one for each destination to which a transfer request is being processed, either due to a C-MOVE request or due to an Archive Manager auto-transfer request.

The number for "Simultaneous DICOM Associations" accepted/running in parallel is configurable. The default value is 40; the permissible range is 10 to 100.

4.2.2.2.3 Asynchronous Nature

The ACOM.net Server DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

4.2.2.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to Table 2 Implementation Identifying Information on page 2.

4.2.2.3 Association Initiation Policy

An association initiation is started either triggered by a previous C-Move Request, by the Archive Manager "auto-transfer" or to archive SOP Instances to a DICOM Archive.

4.2.2.3.1 Activity – Transfer

4.2.2.3.1.1 Description and Sequencing of Activity

The Storage SCU request is triggered either by an Archive Manager request or by a received C-MOVE request. If the process successfully establishes an association to a remote Application

Entity, it will transfer each image one after another via the open association. If the C-STORE Response from the remote Application contains a status other than Success or Warning, the association is aborted.

In case of the C-MOVE triggered request, the “MOVE destinations” must be configured as Storage destinations.

4.2.2.3.1.2 Proposed Presentation Contexts

The ACOM.net Server DICOM application will propose Presentation Contexts depending on configuration of a DICOM destination. The following table lists a “maximum configuration”:

Presentation Context Table – “Auto-Transfer”					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Any image SOP Classes detailed in Chapter Table 1 Network Service Section „Transfer“ on page 2 **(**The US (retired) and US multi-frame (retired) Images will never be proposed, since those instances will be converted to US and US multi-frame during receive.**)**		JPEG Lossy Extended JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None
Any Non-Image SOP Classes detailed in Table 1 Network Service Section „Transfer“ on page 2, e.g. Waveforms		Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None
Private SOP Class detailed in Chapter Table 1 Network Service Section „Transfer (Private SOP Class)“ on page 2		Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None

Table 8. Presentation Context Table “Auto Transfer”

***1**: The Transfer Syntax used is strongly influenced by the fact of "how was the accepted Transfer Syntax at the time when the Instance was received". e.g. the Instances received with JPEG Baseline Transfer Syntaxes will not be converted and can only be sent out with the same Transfer Syntax.

4.2.2.3.1.3 SOP specific Conformance

The ACOM.net Server will not create any DICOM IOD instances. Please see Annex A: IOD Contents for a detailed overview of supported attributes and minimal requirements regarding value encoding. Only Instances successfully received by the ACOM.net Server and fulfilling the conditions for long-term storage transfers (online to near-line or near-line to online), can be sent out via "auto-forward".

Type 3 Attributes with zero length may be removed. Obsolete Spaces may be stripped from attribute values.

Storage of private attributes is supported and therefore extended IOD Instances can be retrieved from the ACOM.net Server DICOM Application. This, however, requires an explicit value representation syntax during receive.

The ACOM.net Server platform supports specific "YBR..." photometric interpretations during image receive process, but those instances will be converted to RGB for further handling.

The ACOM.net Server platform supports the retired Ultrasound format during receive. Such images will be sent out in the standard Ultrasound format, i.e. they will be converted.

4.2.2.4 Association Acceptance Policy

The Acceptance Policy will be described within Chapter Storage SCP AE Specification.

4.2.3 Storage SCP AE Specification

4.2.3.1 SOP Classes

For SOP Classes supported, please refer to Table 1 Network Service Sections „Transfer“ on page 2.

4.2.3.2 Association Establishments Policies

4.2.3.2.1 General

The ACOM.net Server will be able to receive SOP Instances from all DICOM nodes which are configured.

The default PDU size used will be 256 KB.

4.2.3.2.2 Number of Associations

The ACOM.net Server DICOM application is able to receive SOP Instances through several associations at a time from different clients.

The number for "Simultaneous DICOM Associations" accepted/running in parallel is configurable. The default value is 40; the permissible range is 10 to 100.

4.2.3.2.3 Asynchronous Nature

The ACOM.net Server DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

4.2.3.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to Table 2 Implementation Identifying Information on page 2.

4.2.3.3 Association Initiation Policy

The Initiation Policy will be described within Chapter Storage SCU AE Specification.

4.2.3.4 Association Acceptance Policy

The ACOM.net Server DICOM application attempts to accept a new association for

- DIMSE C-ECHO
- DIMSE C-STORE

requests. Any SOP Instance received on a C-STORE Association will be checked. The SOP Instance will be stored in the database if the check was successful.

ACOM.net will only accept Associations from known hosts with a known AET. Hosts and AETs have to be entered in "Local Service" by a Siemens Service Engineer.

4.2.3.4.1 Activity – Receive Images from a Remote Node

4.2.3.4.1.1 Description and Sequencing of Activity

The ACOM.net Server DICOM application will accept an association and will receive SOP Instances according to the listed presentation contexts on that association and will store the

images on disk in the ACOM.net server online storage if the conformance check was performed successfully. There are no specific sequencing constraints.

The ACOM.net Server DICOM application is a "Level **2**" Storage Class Provider.

All received SOP Instances are verified for validity (for details see Annex A: "IOD Mandatory Attributes - Acceptance Criteria", Table 31 and “Storage SCU AE Element ”, Table 32). If this test succeeds, ACOM.net Server returns the status code SUCCESS (0000_H). Otherwise, one of the following status codes is returned and the association is aborted:

Code	Meaning
A700	Refused: Lack of Resources (e.g. not enough disk space)
A900	Invalid Dataset: One of the Attributes “Study Instance UID”, “Series Instance UID” or “SOP Instance UID” is missing or has an invalid value
0110	Error occurred, impossible to proceed

Table 9. Status codes “Receive Response”

After sending the positive status response, the image will be saved into the database. If during this operation an error occurs, the association will be aborted. This implies that a C-STORE-RSP with status SUCCESS does not necessarily mean that the image was successfully stored into the database.

In order to confirm successfull storage of SOP Instances in the database, the Storage Commitment Service can be used.

4.2.3.4.1.2 Accepted Presentation Context

The ACOM.net Server DICOM application will accept Presentation Contexts as shown in the following table:

Presentation Context Table – “Receive”					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
any image SOP Classes detailed in Chapter Table 1 Network Service Section „Transfer“ on page 2 • The US (retired) and US multi-frame (retired) Images will never be proposed, since those instances will be converted to US and US multi-frame during receive. • RLE is only supported for certain US photometric interpretations. With RLE Lossless Transfer Syntax the ACOM.net Server DICOM application will decompress the image before storing it into the database.		JPEG Lossy Extended JPEG Lossless, Process 14 (selection value 1) JPEG Lossy Baseline (Process 1) RLE Lossless Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.4.51 1.2.840.10008.1.2.4.70 1.2.840.10008.1.2.4.50 1.2.840.10008.1.2.5 1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCP	None

Presentation Context Table – "Receive"					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
any Non-Image SOP Classes detailed in Chapter Table 1 Network Service Section „Transfer" on page 2, e.g. Waveforms		Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCP	None
Private SOP Class detailed in Chapter Table 1 Network Service Section „Transfer (Private SOP Class)" on page 2		Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCP	None

Table 10. Presentation Context Table "Receive"

4.2.3.4.1.3 SOP specific Conformance

A SOP Instance received a second time will not overwrite the already stored SOP Instance.

For private Attributes of VR=SQ only a nesting level of one is supported. A private Sequence containing another Sequence will be removed from the Instance. Furthermore, private attributes will only be supported with Explicit VR Transfer syntaxes. Private Attributes in Standard Sequence items will not be supported and the private data are removed.

The ACOM.net Server application supports retired Date and Time-Format when receiving Instances.

The ACOM.net Server DICOM application will accept any number of verification or storage SOP classes that are listed in Table 1 Network Service Section „Transfer" on page 2.

There is no limit on the number of presentation contexts accepted except to the DICOM limitations. In the event that the ACOM.net Server DICOM application runs out of resources, it will reject the association request.

Any proposed presentation context including one of the supported Transfer Syntaxes will be accepted. Any proposed presentation context that does not include one of these Transfer Syntaxes will be rejected.

The order of preference in accepting Transfer Syntaxes within Presentation Contexts or Presentation Contexts with single Transfer Syntaxes is:

Order	DICOM Transfer Syntax
1	JPEG Lossy Extended
2	JPEG Lossless Non-hierarchical
3	JPEG Lossy Baseline
4	RLE Lossless
5	Explicit VR Little Endian
6	Implicit VR Little Endian

Table 11. Order of Preference Transfer Syntax

With Implicit VR Little Endian Transfer Syntax the ACOM.net Server DICOM application will store any Private Attributes not known to the application with Value Representation UN (unknown) in its data base.

The US (retired) and US multi-frame (retired) Images will be converted to US and US multi-frame format during receive.

RLE is only supported for certain US photometric interpretations. With RLE Lossless Transfer Syntax the ACOM.net Server DICOM application will decompress the image before storing it into the database.

syngo identifies a patient by Name, Patient ID, Patient's Sex and Patient's Birth date. Two patients with the same ID but different names are considered two patients by syngo. This should be kept in mind in case such instances are sent to (retrieved by) applications where the ID is the only identification of patient uniqueness.

4.2.4 Storage Commitment SCU Specification

4.2.4.1 SOP Classes

For SOP Classes supported, please refer to Table 1 Network Service Section „Storage Commitment“ on page 2.

4.2.4.2 Association Establishments Policies

4.2.4.2.1 General

Storage Commitment SCU will only be active in case a DICOM Archive is selected for long term archival. Consecutively to archival (see: Table 5 Storage Commitment Sequencing Constraints) of received instances the ACOM.net Server DICOM Application checks all pending commit request for which Instances were archived, forwards the Storage Commitment Request to the DICOM Archive, waits for the response and creates the related commit responses to the requesting Work Station or Modality. For details see Storage Commitment SCP Specification 0.

4.2.4.2.2 Number of Associations

The ACOM.net Server DICOM application is able to initiate several Storage Commitment associations at a time, one for each destination to which a Commit request is being processed.

The number for "Simultaneous DICOM Associations" accepted/running in parallel is configurable. The default value is 40; the permissible range is 10 to 100.

4.2.4.2.3 Asynchronous Nature

The ACOM.net Server DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

4.2.4.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to Table 2 Implementation Identifying Information on page 2.

4.2.4.3 Association Initiation Policy

The ACOM.net Server DICOM Application Entity acts as a Service Class User (SCU) for the

- Storage Commitment Push Model Service Class.

  To do so, the ACOM.net Server will issue a

- N-ACTION DIMSE to forward a received storage commitment request to a DICOM Archive.

An association initiation is triggered by an incoming Storage Commitment Request in case a DICOM Archive is configured.

4.2.4.3.1 Activity – Storage Commitment Request to a DICOM Archive

4.2.4.3.1.1 Description and Sequencing of Activity

Acting as a Storage Commitment User, the ACOM.net Server Storage Commitment AE sends a Storage Commitment request. After successful transfer of images and archiving, ACOM.net server will set the archive flag depending on received Storage Commitment responses (N-EVENT-REPORT).

4.2.4.3.1.2 Proposed Presentation Contexts - Send Commitment Request

The Siemens ACOM.net Server DICOM application will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCU	None

Table 12. Presentation Context Table “Commit Request”

4.2.4.3.1.3 SOP Specific Conformance

Storage Media File-Set ID and UID Attributes will not be supported in the N-ACTION primitive invoked by the Storage Commitment SCU.

Note: Only one N-ACTION-RQ per association is supported by the Storage Commitment SCU.

4.2.4.4 Association Acceptance Policy

The Acceptance Policy will be described within Chapter Storage Commitment SCP Specification.

4.2.5 Storage Commitment SCP Specification

4.2.5.1 SOP Classes

For SOP Classes supported, please refer to Table 1 Network Service Section „Storage Commitment“ on page 2.

4.2.5.2 Association Establishments Policies

4.2.5.2.1 General

Consecutively to archival (see: Table 5 Storage Commitment Sequencing Constraints) of received instances the ACOM.net Server DICOM Application checks all pending commit request for which Instances were archived and creates the related commit responses. The DICOM application will generate a Storage Commitment Response Identifier which references to all Instances of the processed job. Depending on the state of the referred Instances in the commit request the ’Referenced SOP Sequence’ and, in case of archive failures, the ’Failed SOP Sequence’ will be set. Then the Commit Response is sent over a single opened association.

The default PDU size used will be 256 KB.

4.2.5.2.2 Number of Associations

The Siemens ACOM.net Server DICOM application initiates one association for each storage commitment request being replied to. The requests are handled sequentially.

4.2.5.2.3 Asynchronous Nature

The ACOM.net Server DICOM software does not support asynchronous communication (multiple outstanding transactions over a single association).

4.2.5.2.4 Implementation Identifying Information

For Implementation Identifying Information please refer to Table 2 Implementation Identifying Information on page 2.

4.2.5.3 Association Initiation Policy

The ACOM.net Server DICOM Application Entity acts as a Service Class Provider (SCP) for the Storage Commitment Push Model Service Class.

The N-EVENT-REPORT behavior will be described in Chapter 4.2.5.4 Association Acceptance Policy.

4.2.5.4 Association Acceptance Policy

The ACOM.net Server DICOM Application Entity acts as a Service Class Provider (SCP) for the

- Storage Commitment Push Model Service Class.

  To do so, the ACOM.net Server will issue a

- N-EVENT-REPORT DIMSE to respond to a received storage commitment request and the association was closed by the remote system prior to response.

4.2.5.4.1 Activity – Storage Commitment Request from a Remote System

4.2.5.4.1.1 Description and Sequencing of Activity

Acting as a Storage Commitment Provider, the ACOM.net Server Storage Commitment AE receives a Storage Commitment request. After the "Archival Flag" for received instances is set, ACOM.net will initiate an association to send the storage commitment response (N-EVENT-REPORT) to the SCU.

4.2.5.4.1.2 Proposed Presentation Contexts - Send Commitment Response

The Siemens ACOM.net Server DICOM application will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Storage Commitment Push Model	1.2.840.10008.1.20.1	Implicit VR Little Endian Explicit VR Little Endian	1.2.840.10008.1.2 1.2.840.10008.1.2.1	SCP	None

Table 13. Presentation Context Table “Commit Response”

4.2.5.4.1.3 SOP Specific Conformance

Storage Media File-Set ID and UID Attributes will not be supported in the N-EVENT-REPORT primitive invoked by the Storage Commitment SCP.

The Storage Commitment SCP returns following status codes:

Service Status	Meaning	Error Codes
Failed	Not archived	8801
	“don’t archive” flag is set for one or more instances	8802
	One or more instances not found	0112
	UID conflict	0119
	Duplicate Transaction UID	0131
Success	Commitment successful	0000

Table 14. Status Codes Storage Commitment

Note: Only one N-ACTION-RQ per association is supported by the Storage Commitment SCP.

4.2.6 Retrieve SCU Specification

4.2.6.1 SOP Classes

For SOP Classes supported, please refer to Table 1 Network Service Section „Query/Retrieve“ on page 2.

4.2.6.2 Association Establishments Policies

Not applicable. The ACOM.net Server has no means or User Interface to initiate Query/Retrieve Services.

4.2.6.3 Association Initiation Policy

The ACOM.net Server DICOM application will request associations for the following DIMSE-C operations as SCU:

Supported DIMSE operations	Cancel Request supported
C-MOVE	n.a.

Table 15. Supported DIMSE-C Operations

Extended negotiation (relational query) is NOT supported for the above listed services.

The ACOM.net Server Query Retrieve SCU will not support multiple C-MOVE requests over the same association.

4.2.6.3.1 Activity – Retrieve SCU

4.2.6.3.1.1 Description and Sequencing of Activity

Activity C-MOVE

The ACOM.net application sends retrieve requests to a SCP, i.e. a DICOM Archive. The Retrieve SCU supports the query model Patient Root and Study Root. The Retrieve and Storage Service Class SCP behavior is implementation depending. Please refer to the appropriate DICOM Conformance Statement for behavior specification.

4.2.6.3.1.2 Proposed Presentation Contexts

The ACOM.net Server DICOM application will propose Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Query/Retrieve Model Patient and Study Root – **MOVE**	1.2.840.10008.5.1.4.1.2.1.2 1.2.840.10008.5.1.4.1.2.2.2	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCU	None

Table 16. Presentation Context Table “Find”

4.2.6.3.1.3 SOP Specific Conformance

The ACOM.net Server C-MOVE Request Identifier will be structured according to Table 17.

Attribute Name	Tag	Patient Root	Study Root	Comment
Group Length	(0000,0000)	✔	✔	
Affected SOP Class UID	(0000,0002)	✔	✔	1.2.840.10008.5.1.4.1.2.1.2 or 1.2.840.10008.5.1.4.1.2.2.2
Command Field	(0000,0100)	✔	✔	33dec / 0021x
Message ID	(0000,0110)	✔	✔	
Move Destination	(0000,0600)	✔	✔	AET of Store SCP
Priority	(0000,0700)	✔	✔	0000H (MEDIUM)
Data Set Type	(0000,0800)	✔	✔	0000H
Retrieve Level	(0008,0052)	✔	✔	(PATIENT,)STUDY, SERIES, IMAGE
Patient ID	(0010,0020)	✔		Patient Root only
Study Instance UID	(0020,000D)	✔	✔	depending on Model and Retrieve Level
Series Instance UID	(0020,000E)	✔	✔	depending on Retrieve Level
SOP Instance UID	(0008,0018)	✔	✔	depending on Retrieve Level

Table 17. C-MOVE REQ Identifier Structure

4.2.7 Query/Retrieve SCP Specification

4.2.7.1 SOP Classes

For SOP Classes supported, please refer to Table 1 Network Service Section „Query/Retrieve“ on page 2.

4.2.7.2 Association Establishments Policies

Not applicable. The ACOM.net Server has no means or User Interface to initiate Query/Retrieve Services.

4.2.7.3 Association Initiation Policy

Not applicable. The ACOM.net Server has no means or User Interface to initiate Query/Retrieve Services.

4.2.7.4 Association Acceptance Policy

The ACOM.net Server DICOM application will accept associations for the following DIMSE-C operations as SCP:

Supported DIMSE operations	Cancel Request supported
C-FIND	Yes
C-GET	Yes
C-MOVE	Yes

Table 18. Supported DIMSE-C Operations

Extended negotiation (relational query) is NOT supported for the above listed services.

The ACOM.net Server Query Retrieve SCP will support multiple C-FIND requests over the same association, while multiple C-GET or C-MOVE requests over the same association are not supported.

4.2.7.4.1 Activity – Query/Retrieve SCP

4.2.7.4.1.1 Description and Sequencing of Activity

Activity C-FIND

The ACOM.net application responds to query requests from a SCU. Supported are the query models Patient Root, Study Root and Patient/Study Only. Relational retrieve operation is NOT supported. With a C-FIND-CANCEL request the running query can be canceled at any time.

Multiple C-FIND requests over the same association are supported.

Activity C-GET

The ACOM.net application responds to retrieve requests initiated from a SCU. The SCP supports the query model Patient Root, Study Root and Patient/Study Only. The Storage Service Class

Conformance Section describes the C-STORE service, which is generated by the C-GET service. Relational retrieve operation is NOT supported.

Multiple C-GET requests over the same association are NOT supported.

Activity C-MOVE

The ACOM.net application responds to retrieve requests from a SCU. The SCP supports the query model Patient Root, Study Root and Patient/Study Only. The Storage Service Class Conformance Section describes the C-STORE service, which is generated by the C-MOVE service. Relational retrieve operation is NOT supported.

Multiple C-MOVE requests over the same association are NOT supported.

4.2.7.4.1.2 Accepted Presentation Contexts

The ACOM.net Server DICOM application will accept Presentation Contexts as shown in the following table:

Presentation Context Table					
Abstract Syntax		Transfer Syntax		Role	Ext. Neg.
Name	UID	Name List	UID List		
Query/Retrieve all Models – **FIND**	1.2.840.10008.5.1.4.1.2.1.1 1.2.840.10008.5.1.4.1.2.2.1 1.2.840.10008.5.1.4.1.2.3.1	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCP	None
Query/Retrieve all Models – **GET**	1.2.840.10008.5.1.4.1.2.1.3 1.2.840.10008.5.1.4.1.2.2.3 1.2.840.10008.5.1.4.1.2.3.3	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCP	None
Query/Retrieve all Models – **MOVE**	1.2.840.10008.5.1.4.1.2.1.2 1.2.840.10008.5.1.4.1.2.2.2 1.2.840.10008.5.1.4.1.2.3.2	Explicit VR Little Endian Implicit VR Little Endian	1.2.840.10008.1.2.1 1.2.840.10008.1.2	SCP	None

Table 19. Presentation Context Table “Find”

Note: The order of preference for accepting Transfer Syntaxes is:
1. Explicit VR Little Endian, 2. Implicit VR Little Endian.

4.2.7.4.1.3 SOP Specific Conformance

Only Images (Instances) from Online Storage can be retrieved via C-GET or C-MOVE. In case that retrieve is performed on instances that are "near-line", the retrieve request is denied.

All instances which were addressed in the C-GET or C-MOVE Request will be subject to a "bring online" request. Depending on server load and archive bandwidth, the retrieve operation may lead to success if repeated at a later time.

Relational Queries are not supported.

SOP Specifics C-FIND

The ACOM.net Server DICOM Query/Retrieve SCP supports hierarchical queries with all mandatory and optional search keys.

The query attribute contents will be treated case-sensitive.

With wildcard queries the symbol "?" is treated as "*" by the C-FIND SCP application. As a consequence the query string of "?abc*" will be processed as "*abc*".

If the value for the patient-level unique key "Patient ID" is not known, it may be returned with zero length. The attribute “Image Comments” will not be included in the C-FIND-RSP, if it is not set in the database, even if it was requested as return key in the related C-FIND-RQ.

Usage of Storage Media File-Set ID, Retrieve AE Title and Instance Availability with C-FIND-RSP message:

- The *Storage Media File-Set ID* - if existent - can be returned at Study/Series/Image Level. Only on Image Level, the values of ONLINE, NEARLINE or OFFLINE are returned to indicate the Storage Location of the related Instance. (Workaround solution prior to the DICOM existence of *Instance Availability*)

- The *Retrieve AE Title* - if existent - can only be returned at Image Level (for Patient Root and Study Root models) or Study Level (for Patient/Study Only model).

- The *Instance Availability* will be returned on Image Level. The values of ONLINE, NEARLINE or OFFLINE are returned to indicate the Storage Location of the related Instance.

A remote DICOM AE can cancel the running query by sending a C-FIND CANCEL. Matches are possibly continuing (more C-FIND response with status PENDING) until the cancel operation has completed.

The supported attributes on the various query levels of the three supported information models are listed in the table below.

Attribute Name	Tag	Key	Matching	Patient Root	Patient /Study only		Study Root	
Patient Name	(0010,0010)	R	S, W, U	✔	✔	Patient Level	✔	Study Level
Patient ID	(0010,0020)	U	S, W, U	✔	✔		✔	
Patient’s Birth Date	(0010,0030)	O	S, R, U	✔	✔		✔	
Patient’s Birth Time	(0010,0032)	O	S, R, U	✔	✔		✔	
Patient’s Sex	(0010,0040)	O	S, W, U	✔	✔		✔	
Ethnic Group	(0010,2160)	O	S, W, U	✔			✔	
Patient Comments	(0010,4000)	O	W, U	✔	✔		✔	
Number of Patient related Studies	(0020,1200)	O	U	✔	✔		✔	
Number of Patient related Series	(0020,1202)	O	U	✔	✔		✔	
Number of Patient related Instances	(0020,1204)	O	U	✔	✔		✔	
Study Instance UID	(0020,000D)	U	S, UID	✔	✔	Study Level	✔	
Study ID	(0020,0010)	R	S, W, U	✔	✔		✔	
Study Date	(0008,0020)	R	S, R, U	✔	✔		✔	
Study Time	(0008,0030)	R	S, R, U	✔	✔		✔	
Accession Number	(0008,0050)	R	S, W, U	✔	✔		✔	
Referring Physician´s Name	(0008,0090)	O	S, W, U	✔	✔		✔	
Study Description	(0008,1030)	O	S, W, U	✔	✔		✔	
Admitting Diagnosis Description	(0008,1080)	O	S, W, U	✔	✔		✔	
Patient’s Age	(0010,1010)	O	S, W, U	✔	✔		✔	
Patient’s Size	(0010,1020)	O	S, U	✔	✔		✔	
Patient’s Weight	(0010,1030)	O	S, U	✔	✔		✔	
Occupation	(0010,2180)	O	S, W, U	✔	✔		✔	
Additional Patient History	(0010,21B0)	O	W, U	✔	✔		✔	
Name of Physician reading the Study	(0008,1060)	O	S, W, U	✔	✔		✔	
Modalities in Study	(0008,0061)	O	M, U	✔	✔		✔	

Attribute Name	Tag	Key	Matching	Patient Root	Patient /Study only		Study Root	
Number of Study Related Series	(0020,1206)	O	U	✔	✔		✔	
Number of Study Related Instances	(0020,1208)	O	U	✔	✔		✔	
Series Instance UID	(0020,000E)	U	S, UID	✔			✔	Series Level
Series Number	(0020,0011)	R	S, U	✔			✔	
Modality	(0008,0060)	R	S, W, U	✔			✔	
Laterality	(0020,0060)	O	S, W, U	✔			✔	
Body Part Examined	(0018,0015)	O	S, W, U	✔			✔	
Patient Position	(0018,5100)	O	S, W, U	✔			✔	
Smallest Pixel Value in Series	(0028,0108)	O	S, U	✔			✔	
Largest Pixel Value in Series	(0028,0109)	O	S, U	✔			✔	
Protocol Name	(0018,1030)	O	S, W, U	✔			✔	
Series Date	(0008,0021)	O	S, R, U	✔			✔	
Series Time	(0008,0031)	O	S, R, U	✔			✔	
Series Description	(0008,103E)	O	S, W, U	✔			✔	
Operator's Name	(0008,1070)	O	S, W, U	✔			✔	
Performing Physician's name	(0008,1050)	O	S, W, U	✔			✔	
Performed Procedure Step Start Date	(0040,0244)	O	U	✔			✔	
Performed Procedure Step Start Time	(0040,0245)	O	U	✔			✔	
Number of Series related Instances	(0020,1209)	O	U	✔			✔	
SOP Instance UID	(0008,0018)	U	S, UID	✔			✔	Image Level
Image Number	(0020,0013)	R	S, U	✔			✔	
Image Date	(0008,0023)	O	S, R, U	✔			✔	
Image Time	(0008,0033)	O	S, R, U	✔			✔	
Modality	(0008,0060)	O	S, W, U	✔			✔	
Image Comments	(0020,4000)	O	U	✔			✔	

Table 20. Information Models – Supported Attributes

Abbreviation	Meaning
S	Single Value
W	Wildcard
U	Universal
R	Range
M	Multi Value
UID	List of UIDs

Table 21. Matching Capabilities

SOP Specifics C-GET

Since C-GET method implies that the storage sub-operations occur on the same association, all transfer presentation contexts must be part of the related association negotiation.

All unique keys have to be supplied according to the selected Query/Retrieve Level. The related tables in the C-FIND SCP section will give information about "U" marked key attributes.

SOP Specifics C-MOVE

At association establishment time the C-MOVE presentation context must be negotiated. The C-STORE sub-operations are performed on a different association to the AET specified in the C-MOVE request, in order to transfer images to a remote Storage Service Class Provider.

All unique keys have to be supplied according to the selected Query/Retrieve Level. The related tables in the C-FIND SCP section will give information about "U" marked key attributes.

C-FIND, C-GET and C-Move will return the following status codes:

Service Status	Meaning	Error Codes	Related Fields	FIND	GET	MOVE
Refused	Out of Resources	A700	(0000,0902)	✔		
	Out of Resources – Unable to calculate number of matches	A701	(0000,0902)		✔	✔
	Out of Resources – Unable to perform sub operations	A702	(0000,1020) (0000,1021) (0000,1022) (0000,1023)		✔	✔
Failed	Identifier does not match SOP Class	A900	(0000,0901) (0000,0902)	✔	✔	✔
	Unable to process	C001	(0000,0901) (0000,0902)	✔	✔	✔
Cancel	Matching terminated due to Cancel Request	FE00	None	✔		
	Sub Operations terminated due to Cancel Request	FE00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)		✔	✔
Warning	Sub Operations complete – One or more Failures or Warnings	B000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)		✔	✔
Success	Matching is complete - No final Identifier is supplied	0000	None	✔		
	Sub Operations complete –No Failures or Warnings	0000	(0000,1020) (0000,1021) (0000,1022) (0000,1023)		✔	✔
Pending	Matches are continuing - Current Match is supplied and any Optional Keys were supported in the same manner as Required Keys	FF00	Identifier	✔		
	Sub Operations continuing	FF00	(0000,1020) (0000,1021) (0000,1022) (0000,1023)		✔	✔
	Matches are continuing - Warning that one or more Optional Keys were not supported for existence and/or matching for this identifier	FF01	Identifier	✔		

Table 22. Status Codes FIND/GET/MOVE

4.3 Network Interfaces

4.3.1 Physical Network Interface

The ACOM.net Server DICOM application supports a single network interface. One of the following network interfaces has to be available.

Network Interface	Comment
Ethernet 10baseT	Restrictions (refer to User Manual)
Ethernet 100baseT	
Ethernet Gigabit	

Table 23. Network Interfaces

4.3.2 Additional Protocols

not applicable.

4.4 Configuration

4.4.1 AE Title/Presentation Address Mapping

Local AE Titles

Following the DICOM Standard, the AET string can be up to 16 characters long and must not contain any extended characters, only 7-bit ASCII characters (excluding Control Characters).

Note: Please be aware that syngo is more restrictive. Spaces and special characters (&<>") are not supported in the AE Title string.

Application Entity	Role	Default AET	TCP/IP Port
Verification SCP	SCP	HOSTNAME in Capital Letters	104
Storage SCU	SCU	HOSTNAME in Capital Letters	-
Storage SCP	SCP	HOSTNAME in Capital Letters	104
Storage Commitment SCU	SCU	HOSTNAME in Capital Letters	-
Storage Commitment SCP	SCP	HOSTNAME in Capital Letters	104
Query/Retrieve SCU	SCU	HOSTNAME in Capital Letters	-
Query/Retrieve SCP	SCP	HOSTNAME in Capital Letters	104

Table 24. Default AET Characteristics

Note: AET will be identical for all AETs supported. The port number is not configurable

Remote AE Titles

All external AE Titles have to be configured to be able to communicate with ACOM.net. ACOM.net only allows communication with known nodes (trusted host principle).

4.4.2 Parameters

General Parameters				
Parameter	**Default Value**	**Min**	**Max**	**Comment**
Number of Auto-Forward Destinations	n.a.	0	3	
Target for Auto-Forward Destinations	n.a.			• path to a file share or • Remote Node (see below)
Number of simultaneous DICOM associations accepted/used	40	10	100	
Maximum PDU Size for Send and Receive	256kB	4kb	1MB	4kB: 4096 bytes 1MB: 1048576 bytes

Table 25. General Configuration Parameters

Remote Node Configuration		
Parameter	**Entry**	**Comment**
Remote Node	Logical Name	Name seen in User Interface
	Host Name	
	TCP/IP Address	
	Port Number	Port Number of Remote Application
	AET	Application Entity Title
	Transfer Syntaxes	Selection of Transfer Syntaxes
DICOM Archive (one "read/write" and up to five "read only")	Logical Name	Name seen in User Interface
	Host Name	
	TCP/IP Address	
	Port Number	Port Number of Remote Application
	AET	Application Entity Title
	Transfer Syntaxes	Selection of Transfer Syntaxes
	Query Model • Study Root • Patient Root	Query Model to retrieve information from Archive. Default Model: Study Root "Patient/Study only" is not supported
	Retrieve Type • C-MOVE • C-GET	How to initiate transfer of data Default: C-MOVE
	Acom.NET based	Yes/No
	Storage Commitment (SC)	Yes/No
	Use different SC Node	Yes/No if Yes, logical name, host name, TCP/IP address, Port Number and AET for this Storage Commitment node have to be entered
	Max Time for Archiving	Number of Hours ACOM.net will try to reach the DICOM Archive

Table 26. Remote Node Configuration

All remote node configuration parameters are configured using the ACOM.net Server Service/Installation Tool. For each AET the list of services supported can be configured. For Storage Targets the supported Transfer Syntaxes can be pre-selected.

Time-out Values				
Parameter	**Default Value [sec]**	**Min [sec]**	**Max [sec]**	**Comment**
Accepting/Rejecting an Association Request	240	15	600	Wait for an Association Request or wait for a Peer to shut down the Association

Association Open Request	240	15	600	Wait for a reply to an Association Accept Request
Association Close Request	240	15	600	Wait for a reply to an Association Release Request
Accepting a Message over Network	240	15	600	Wait for a Network Write to be accepted
Waiting for Data between TCP/IP Packets	240	15	600	Wait for Data between TCP/IP packets
Response from Remote Node for Storage/Query/Retrieve	600	15	600	Time between Service Request and Service Response
Accept Network Connect	240	15	600	Wait for a Network connect to be accepted

Table 27. Time-Out Values

Storage Commitment Time-Outs				
Parameter	**Default Value [sec]**	**Min [sec]**	**Max [sec]**	**Comment**
Commit to Archive	86400 (24h)			see Note 1
Send Commit Response	86400 (24h)			see Note 2
Response Time Span	07:00-20:00			

Table 28. Storage Commitment Time-Out

Note 1: Commit to Archive defines the time between the Commitment Request from the SCU and the actual Archival Storage.

Note 2: Send Commit Response Time-Out defines the time until the Remote Storage Commitment SCU is reachable.

Minimum and Maximum values are depending on installation and local situation

These parameters can only be configured through access to the Windows Registry.

HKEY_LOCAL_MACHINE = <HKLM>

- <HKLM>\Software\Siemens\ACOMnet\AcnStuInterface\WaitTimeArchiveFlag
  Type: DWORD, Value: Time in SECONDS (86400 = 24h)
- <HKLM>\Software\Siemens\ACOMnet\AcnStuInterface\ResponseTimeSpan
  Type: STRING, Value: [hh:mm-hh:mm]
- <HKLM>\Software\Siemens\ACOMnet\AcnStuInterface\WaitTimeCommit
  Type: DWORD, Value: Time in SECONDS (86400 = 24h)

5 Media Interchange

ACOM.net DICOM Media Storage is not intended for interchange.

6 Support of Extended Character Sets

DICOM Character Set	Comment	Text Display
ISO_IR 100	ISO 8859 Latin 1	Support of text display in browser and viewer of the related ACOM.net clients
any other DICOM Character Set including		
ISO-IR 13	JIS X 0201	Supported for Image Storage Text display in browser and viewer of the related ACOM.net clients is not supported
ISO-IR 14		
ISO-IR 87	JIS X 0208	
ISO-IR 159	JIS X 0212	
ISO 2022 IR 100		
Mismatch between the tag (0008,0005) and the characters in an IOD		Import with ISO_IR 100. If ISO_IR 100 fails, convert each illegal character to a '?'

Table 29. Supported Character Sets

7 Security

7.1 Security Profiles

ACOM.net does not support Digital Signatures Security Profile.

7.2 Association Level Security

ACOM.net will check the following DICOM Values to determine whether to accept an Association Open Request.

Checked Values
Calling AET
Called AET
Host Name
TCP/IP Address

Table 30. Trusted Host Table

A remote node has to be configured to be allowed to communicate.

Annex A: IOD Contents

A.1 Storage SCP AE Element Use

Only attributes with specific significance for ACOM.net are listed here. All other DICOM attributes present in an incoming IOD are stored as they are.

Description of columns in Table below

Server Transfer
XA, SC, NM, US (includes US and US multi-frame) and WF (for Waveforms) or “all” indicates that this attribute or value is mandatory to enable Storage onto the Server (minimal Header requirement).

Archive
An entry indicates that this attribute needs to be set with value in order to allow storage in a near-line (long-term) archive. For attributes marked with an asterisk “*” it is configurable, if the value is mandatory for enabling near-line (long-term) storage.

Client-Display
A "B" indicates an attribute being mandatory for correct and consistent display in the Browser while a "V" indicates that the attribute is required to enable image viewing. Combination "B,V" is possible, else the field is left blank intentionally.

Client-Export (EX)
ACOM.net clients will have the capability to export images by transforming them to Non-DICOM File Formats. An attribute marked "M" is mandatory for a correct transformation. Else the field is left blank intentionally.

Attribute Name	Tag	Comments	Server-Transfer	Archive	Client-Display	EX
Specific Character Set	(0008,0005)	see: Chapter 6 "Support of Extended Character Sets"			B,V	
Image Type	(0008,0008)				B	
SOP Class UID	(0008,0016)	appropriate SOP Class UID	all	all	B,V	
SOP Instance UID	(0008,0018)		all	all	B	
Study Date	(0008,0020)	<yyyymmdd>		all		
Study Time	(0008,0030)	<hhmmss>		all		
Accession Number	(0008,0050)	(Correction via ACOM.net client or HL7 is supported)		all*		
Modality	(0008,0060)	XA: XA or RF SC: SC NM: NM US: US Waveform Modality		all	B	
Conversion Type	(0008,0064)		SC			
Patient’s Name	(0010,0010)	(Correction via ACOM.net client or HL7 is supported)		all*		
Patient ID	(0010,0020)	(Correction via ACOM.net client or HL7 is supported)		all*		
Patient’s Birth Date	(0010,0030)	<yyyymmdd> or <yyyy.mm.dd> (Correction via ACOM.net client or HL7 is supported)		all*		
Patient’s Sex	(0010,0040)	M or F or O (Correction via ACOM.net client or HL7 is supported)		all*		
Study Instance UID	(0020,000D)		all	all	B	
Series Instance UID	(0020,000E)		all	all	B	

Study ID	(0020,0010)	(Correction via ACOM.net client is supported)		all*		
Series Number	(0020,0011)			all		
Instance Number	(0020,0013)	(value needed for correct sorting)		all	B	
Samples per Pixel	(0028,0002)	1 : all 3 : SC US	all		V	M
Photometric Interpretation	(0028,0004)	MONOCHROME2 - all MONOCHROME1 - SC RGB – SC NM US PALETTE COLOR - SC NM US YBR_FULL - US YBR_FULL_422 - US YBR_PARTIAL_422 - US ARGB - US	all		V	M
Planar Configuration	(0028,0006)	00 or 001	SC		V	M
Number of Frames	(0028,0008)	<actual number of frames>			V	
Frame Increment Pointer	(0028,0009)	00181063_H or 00181065_H	XA USmf			
Rows	(0028,0010)	≤ 3072	all		V	M
Columns	(0028,0011)	≤ 3072	all		V	M
Bits Allocated	(0028,0100)	8 or 16	all		V	M
Bits Stored	(0028,0101)	8 all 10 XA SC 12 XA SC 16 SC NM US	all		V $V_{(bitsclipped)}$ $V_{(bitsclipped)}$	M
High Bit	(0028,0102)	Bits stored - 1	all		V	M
Pixel Representation	(0028,0103)	0	all		V	M
Pixel Intensity Relationship	(0028,1040)	LIN or LOG			$V_{(native)}$	
Window Center	(0028,1050)	(value needed for correct display)			V	
Window Width	(0028,1051)	(value needed for correct display)			V	
Recommended Viewing Mode	(0028,1090)	NAT or SUB			Always NAT	
Representative Frame Number	(0028,6010)	Value needed to create Icon Image, else black Icon Image!	*XA*		B,V	
Performed Procedure Step ID	(0040,0253)				B	
Curve Dimensions	(50xx,0005)				V	
Number of Points	(50xx,0010)				V	
Axis Units	(50xx,0030)				V	
Curve Data Descriptor	(50xx,0110)				V	
Coordinate Step Value	(50xx,0114)				V	
Curve Data	(50xx,3000)				V	
Overlay Rows	(60xx,0010)				V	
Overlay Columns	(60xx,0011)				V	
Number of Frames in Overlay	(60xx,0015)				V	
Overlay Origin	(60xx,0050)				V	
Image Frame Origin	(60xx,0051)				V	
Overlay Bits Allocated	(60xx,0100)	16_d or 1_d(with [60xx,3000])			V	
Overlay Bit Position	(60xx,0102)	0 or 12_d or 13_d or 14_d or 15_d			V	
Overlay Data	[60xx,3000]				V	
Pixel Data	(7FE0,0010)	NM US: compressed images without offset table have reduced frame rate during review WF: no viewing possible	all	all	V	M

Table 31. IOD Mandatory Attributes - Acceptance Criteria

A.2 Storage SCU AE Element Modification

Attribute Name	Tag	Default Value
Study Date	(0008,0020)	<unknown, zero length>
Image Date	(0008,0023)	<unknown, zero length>
Study Time	(0008,0030)	<unknown, zero length>
Image Time	(0008,0033)	<unknown, zero length>
Accession Number	(0008,0050)	<unknown, zero length> (can be changed via ACOM.net client unless in long-term storage)
Manufacturer	(0008,0070)	<unknown, zero length>
Referring Physician's Name	(0008,0090)	<unknown, zero length>
Study Description	(0008,1030)	<unknown, zero length>
Patient's Name	(0010,0010)	<unknown, zero length> (can be changed via ACOM.net client unless in long-term storage)
Patient ID	(0010,0020)	<unknown, zero length> (can be changed via ACOM.net client unless in long-term storage)
Patient's Birth Date	(0010,0030)	<unknown, zero length> (can be changed via ACOM.net client unless in long-term storage)
Patient's Sex	(0010,0040)	<unknown, zero length> (can be changed via ACOM.net client unless in long-term storage)
Patient Comments	(0010,4000)	<value (only when entered via ACOM.net client)>
Contrast/Bolus Agent	(0018,0010)	<unknown, zero length>
KVP	(0018,0060)	<unknown, zero length>
Counts Accumulated	(0018,0070)	<unknown, zero length>
Exposure Time	(0018,1150)	<unknown, zero length>
X-Ray Tube Current	(0018,1151)	<unknown, zero length>
Positioner Primary Angle	(0018,1510)	<unknown, zero length>
Positioner Secondary Angle	(0018,1511)	<unknown, zero length>
Study ID	(0020,0010)	<unknown, zero length> (can be changed via ACOM.net client unless in long-term storage)
Series Number	(0020,0011)	<unknown, zero length>
Image Number	(0020,0013)	<unknown, zero length>
Patient Orientation	(0020,0020)	<unknown, zero length>
Pixel Spacing	(0028,0030)	<unknown, zero length>
Window Center	(0028,1050)	internal default: Window Width / 2
Window Width	(0028,1051)	internal default: calculated from "Bits Stored"
Recommended Viewing Mode	(0028,0102)	<unknown, zero length>
Representative Frame Number	[0028,6010]	number of frames / 2
Calibration Image	(0050,0004)	<unknown, zero length>
Energy Window Information SQ	(0054,0012)	<unknown, zero length>
Detector Information SQ	(0054,0022)	<unknown, zero length>
Rotation Information SQ	(0054,0052)	<unknown, zero length>
Patient orientation Code SQ	(0054,0410)	<unknown, zero length>
Patient Gantry Relationship Code SQ	(0054,0414)	<unknown, zero length>

Table 32. Applied Defaults

Annex B: HL7 Extension

B.1. Patient Reconciliation Interface ARI

B.1.1. General

The Acom.NET Patient Reconciliation Interface ARI HL7 Service is a one-directional service to receive messages on a single specified port. Only specific fields from specific segments of ADTA08, ADTA34 and ADTA40 messages are analyzed by ARI. ADTA08 is for updating existing patient's information. ADTA34 or ADTA40 messages will allow merging two patients or to modify a patient's ID. It is configurable whether a particular station is allowed to send messages to ARI.

Message Delimiters

The Acom.NET Patient Reconciliation Interface expects the following delimiters to be used by any sender of appropriate HL7 messages. Other delimiters are not supported.

	HL7
Segment Terminator	<CR>
Field Separator	|
Component Separator	^
Sub-Component Separator	&
Repetition Separator	~
Escape Character	\

Table 33. Message Delimiters

Message Framing

The Acom.NET Patient Reconciliation Interface expects the following framing delimiters to be used by any sender of appropriate HL7 messages. Other framing delimiters or no framing delimiters are not supported.

	HL7
Header Framing	0x0B
Tail Framing	0x1C 0D

Table 34. Message Framing

As indicated in Chapter B.1.2, only certain fields are used to update the database of ACOM.net. The segments which contain data to be used for data base updates are indicated in **bold**.

All other segments within a HL7 message will be ignored.

Message Definitions

Depending on Message Type, only certain Segments are evaluated. All other Segments are ignored since they contain no information for updating the ACOM.net server's database. For Segments used see Table below.

Seg	Name	A08	A34/ A40
MSH	Message Header	Yes	Yes
EVN	Event Type	Yes	Yes
PID	**Patient Identification**	**Yes**	**Yes**
PV1	**Patient Visit**	**Yes**	**Yes**
…			
MRG	**Merge Information**		**Yes**
…			

Table 35. Segments evaluated

B.1.2. ADTA08 Patient Update

The Patient Administration A08 message is sent out by an Information System when patient administrative data was modified. The patient ID has to be unique as this is used to identify the patient in the local database. The update is performed for non-archived patients only.

The following patient data can be modified in the data base:

Attribute	Comment
Patient Name	converted from HL7 to DICOM
Patient Birth Date	yyyymmdd
Patient Sex	M, F or O
Accession Number	HL7 field configurable
Performing Physician	converted from HL7 to DICOM
Referring Physician	converted from HL7 to DICOM

Table 36. Modifiable Attributes (A08)

B.1.3. ADTA34 / ADTA40 Patient Merge

The Patient Administration A34 or A40 message is used when two patients are merged to one, i.e. data of patient with Patient ID B is merged to patient with Patient ID A or in case a patient's ID has to be modified. The update is performed for non-archived patients only. A34 is supported for backward compatibility only. HL7 Version 2.5 uses A40 for merging patient information.

The following patient data can be modified in the data base:

Attribute	Comment
Patient ID	additionally converted from HL7 to DICOM

Table 37. Modifiable Attribute (A34/A40)

Whenever an A34/A40 message is received, ARI will try to execute the merge. Since A34/A40 messages are usually only sent once and related SOP instances might not have been received by the ACOM.net Server, these A34/A40 messages will be kept in a buffer for a configurable number of days (default: 20 days). Each incoming A08 message triggers an attempt to execute these buffered messages.

B.1.4. Fields used for Patient Update / Merge

PID Segment (A08 and A34/A40)

(Complete segment not shown)

Segment Type/ Field Component	Description
PID:3	Patient Identifier List
PID:4	Accession Number
PID:5	Patient Name
PID:7	DateTimeOfBirth (only date used for DICOM update)
PID:8	Sex

Table 38. PID Segment

PV1 Segment (A08 only)

(Complete segment not shown)

Segment Type/ Field Component	Description
PV1:7	Performing Physician
PV1:8	Referring Physician

Table 39. PV1 Segment

MRG Segment (A34/A40 only)

(Complete segment not shown)

Segment Type/ Field Component	Description
MRG:1	Prior Patient Identifier List

Table 40. MRG Segment

Explanatory Note: For A08 message the Patient ID (PID:3) is used as the unambiguous identifier to modify patient information, for A34/A40 messages ARI will search for the "old" Patient ID (MRG:1) and replace it with the "new" Patient ID (PID:3).

B.1.5. Configuration

HL7 Field Definition

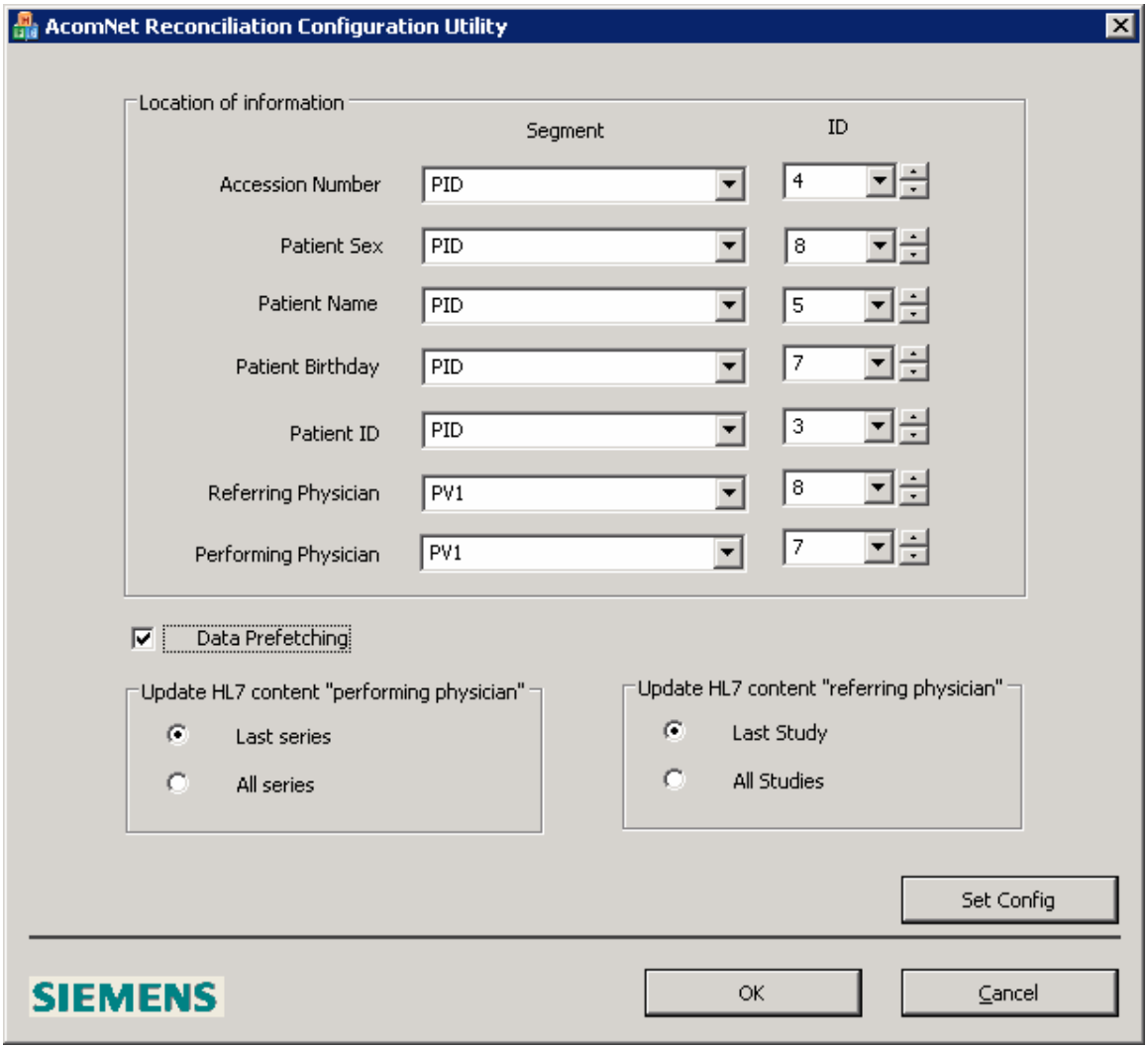

Table 41. HL7 Field Configuration

Table 41 shows all configurable items and their default settings. Depending on the local HIS/RIS, e.g. the accession number could be configured to be received in a HL7 message in field PID-18 instead of PID-4. Modifying the default configuration has to be done according to the local HIS/RIS.

For Prefetching, please refer to Annex B.2 "Data Prefetching"

In DICOM the Performing Physician is defined on Series Level. Depending on location, it might be preferable not only to update the latest Series, but all Series within this Study.

If configured that the update should be performed for the whole Study, all Series which are not archived will be updated.

In DICOM the Referring Physician is defined on Study Level. Depending on location, it might be preferable not only to update the latest Study, but all Studies from this Patient.

If configured that the update should be performed for the whole Patient, all Studies which are not archived will be updated.

General Settings

The parameters in Table 42 can only be configured through access to the Windows Registry.

Parameter	Default
Port number of ARI waiting for incoming HL7 messages	5007
Number of days a not-executed A34 (A40) message shall be buffered	20
Subdirectory path for ARI buffer/log files	%ACN_LOGFILE_PATH%\ari

Table 42. Configuration Parameters in Registry

B.1.6. Special Behavior (Patient Update A08)

Accession Number

In DICOM the accession number is defined on Study level. If a given patient has more than one Study, the following rules apply.

	Case	Action
1	Only one Study available	This Study will get the Accession Number
2	More than one Study, but only one not archived	This, not-archived, Study will get the Accession Number
3	More than one Study, more than one not archived	• if one of these Studies got this Accession Number already, nothing else will be done • if none of the Studies got this Accession Number, the latest Study will get this Accession Number
4	HL7-Message does not "carry" an Accession Number	Nothing will be modified

Table 43. Accession Number

Note: Equivalent rules do also apply for handling of Performing and Referring Physician.

Mapping of HL7 Fields to DICOM

The following table shows the relation between DICOM attributes and HL7 Fields.

HL7 Name	Segment Number (Default)	VR	DICOM Name	DICOM Tag	VR
Patient ID (retired)	PID-02	CX	Accession Number	0008,0050	SH
Patient Identifier List	PID-03	CX	Patient ID	0010,0020	LO
Alternate Patient ID	PID-04	CX	Accession Number	0008,0050	SH
Patient Name	PID-05	XPN	Patient Name	0010,0010	PN
Patient Birth Date	PID-06	TS	Patient Birth Date	0010,0030	DA
Patient Sex	PID-08	IS	Patient Sex	0010,0040	CS
Patient Account Number	PID-18	CX	Accession Number	0008,0050	SH
Attending Physician Name	PV1-07	XCN	Performing Physician Name	0008,1050	PN
Referring Physician Name	PV1-08	XCN	Referring Physician Name	0008,0090	PN

Table 44. Mapping of HL7 Fields to DICOM

Value Representation of HL7 Fields and DICOM Attributes

Standard	VR	Description
DICOM	CS	16 characters (A-Z, 0-9," ","_")
DICOM	DA	YYYYMMDD
DICOM	LO	64 characters, no "\"
DICOM	PN	Family Name, Given Name, Middle Initial, Prefix, Suffix
DICOM	SH	16 characters, no "\"
HL7	CX	ID Number, Check Digit, … DICOM only uses the first entry
HL7	IS	max len = 20 (value defined in table)
HL7	TS	YYYYMMDDHHMMSS.SSSS+/-ZZZZ
HL7	XCN	ID number, Family Name, Given Name, Middle Initial, Suffix, Prefix, …
HL7	XPN	Family Name, Given Name, Middle Initial, Suffix, Prefix, …

Table 45. Value Representation of HL7 and DICOM

HL7	DICOM
Patient Name	(XPN -> PN): suffix and prefix are switched
Birth Date	(TS -> DA): Time part of TS is disregarded
Physician Name	(XCN -> PN): suffix and prefix are switched and first part of XCN (ID Number) is disregarded

Table 46. Mapping of HL7 Fields to DICOM Attributes

Patient Sex

Abbreviation	Meaning	DICOM supported	HL7 supported	Action
A	Ambiguous		Yes	Patient Sex encoded with zero length
F	Female	Yes	Yes	Patient Sex encoded with "F"
M	Male	Yes	Yes	Patient Sex encoded with "M"
N	Not applicable		Yes	Patient Sex encoded with zero length
O	Other	Yes	Yes	Patient Sex encoded with "O"
U	Unknown		Yes	Patient Sex encoded with zero length

Table 47. Mapping Patient Sex from HL7 to DICOM

Unknown Segments

Acom.NET Patient Reconciliation Interface will parse and ignore unknown Segments, including Z-Segments.

B.2. Data Prefetching

It can be configured that all incoming HL7 messages will check the online status of data belonging to this patient, identified by his or her Patient ID (PID:3). In the case data is found with the status near-line, a request will be initiated to get these data online again. Queries performed later for this patient will have most likely data already available for review.

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